CLAIMS

1. A method of producing a film of gallium nitride (GaN) using a substrate, by deposition of GaN by epitaxy, characterised in that the deposition of GaN comprises at least one step of epitaxial lateral overgrowth (ELO) and in that it comprises a step of separating part of the layer of GaN from its substrate by weakening by ion implantation in the layer of GaN directly.

2. A method of producing a film of gallium nitride (GaN) according to Claim 1, characterised in that it comprises the following successive steps:

(i) the deposition of a layer of GaN on a substrate by vapour or liquid phase epitaxy,

(ii) a weakening ion implantation step so as to create a weak area in the layer of GaN deposited during the previous step,

(iii) a step of reworking by epitaxial lateral overgrowth (ELO) in order to form a new layer of GaN and

(iv) a spontaneous separation step at the weak area.

3. A method according to Claim 2, characterised in that the deposition of GaN during step (i) is effected by epitaxy by vapour or liquid phase epitaxial lateral overgrowth ELO.

4. A method according to Claim 3, characterised in that step (i) is implemented by vapour phase epitaxy technology using halides and hydrides (HVPE), by organometallic pyrolysis vapour phase epitaxy (EPVOM) technology or by sublimation (CSVT).

5. A method according to Claim 3 or 4, characterised in that step (i) comprises the following steps:

- deposition of a layer of GaN,

- deposition of a dielectric layer which is etched in order to obtain openings,

- deposition of GaN in the areas of GaN located in the openings, and then

- deposition of GaN giving rise to a lateral overgrowth until the patterns of GaN coalesce.

6. A method according to Claim 3 or 4, characterised in that step (i) is a step of spontaneous ELO which comprises the following steps:

- deposition of silicon nitride to a thickness of around 10 to 20 nm,

- deposition of a continuous buffer layer of GaN,

- annealing at a high temperature of between 1050° and 1120°C so that the buffer layer converts from a continuous layer to a discontinuous layer formed from patterns of GaN in the form of islands, and then

- deposition by epitaxy of GaN.

7. A method according to Claim 6, characterised in that the implantation is effected either in the islands, or at an intermediate stage where the islands are not entirely coalesced, or after total coalescent of these islands.

8. A method according to one of Claims 1 to 7, characterised in that the implantation ions can be chosen from amongst H^+, ions of rare gas such as helium, neon or krypton, as well as boron.

9. A method according to any one of Claims 1 to 8, characterised in that the implantation energies can vary from 80 to 160 keV.

10. A method according to any one of Claims 1 to 9, characterised in that the ions implanted in the layer of GaN are H^+ ions.

11. A method according to Claim 10, characterised in that the implantation ions are H^+ ions and the H^+ ion implantation dose varies from 10^{16} to 10^{17} cm^{-2}.

12. A method according to any one of Claims 2 to 11, characterised in that the spontaneous separation at the weak area of the layer formed during step (i) defined in Claim 2 is implemented by a return to ambient temperature after the resumption of epitaxy.

13. A method according to any one of Claims 1 to 12, characterised in that the depth of implantation varies from 50 nm up to the GaN/initial substrate interface.

14. A method according to any one of Claims 1 to 13, characterised in that the substrate is chosen from amongst sapphire, ZnO, 6H-SiC, $LiAlO_2$, $LiAlO_2$, $LiGaO_2$, $MgAlO_2$, Si, GaAs, AlN or GaN.

15. A method according to Claim 14, characterised in that the substrate is a sapphire substrate.

16. A method according to any one of Claims 2 to 15, characterised in that the epitaxial lateral overgrowth according to step (iii) as defined in Claim 2 is performed by EPVOM, HVPE or CSVT epitaxy or liquid phase epitaxy (LPE).

17. A method according to any one of Claims 1 to 16, characterised in that the gallium nitride is doped during at least one of the epitaxial lateral overgrowth steps by means of a doping substance which may be chosen from amongst magnesium, zinc, beryllium, calcium, carbon, boron or silicon.

18. A film of gallium nitride, characterised in that it is able to be obtained by a method according to any one of Claims 1 to 17.

19. A film of gallium nitride according to Claim 18, characterised in that it has a thickness of more than 50 µm.

20. A substrate after separation of the layer of gallium nitride by ion implantation according to the method as described in any one of Claims 1 to 17, comprising part of the GaN directly deposited on the substrate during step (i) as defined in Claim 2, by way of new substrate which can be used for subsequent reworking by GaN epitaxy.

21. Use of the substrate after separation of the layer of gallium nitride by ion implantation according to the method as defined in any one of Claims 1 to 17, comprising part of the GaN directly deposited on the substrate during step (i) as defined in Claim 2, by way of new substrate for reworking by GaN epitaxy.

22. An optoelectronic component, characterised in that it is provided with a film of GaN according to Claim 18 or 19.

23. A laser diode, a UV light-emitting diode, photodetector or transistor, characterised in that it is provided with a film of GaN according to Claim 18 or 19.